

# Comparison of Different Foot Pedal Illumination Strategies and Their Effect Upon Speed and Accuracy of Activation and Dark Adaptation

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## INTRODUCTION AND OBJECTIVES:

Endourologic procedures frequently employ foot pedal activation in a low-light intensity operating room (OR) environment. Operating foot pedals in low-light settings may result in unintentional instrument activation and patient harm, while a brightly lit room may hinder dark adaptation during endoscopic procedures. The purpose of this study is to compare speed and accuracy, dark adaptation, and surgeon preference for foot pedal operation under two types of pedal illumination, as well as in a dark and brightly lit OR setting.

**METHODS:** During a simulated Percutaneous Nephrolithotomy (PCNL) procedure, the foot pedals for a c-arm, holmium laser, and ultrasonic lithotripter (USL) were randomized to 3 different positions. Twenty participants activated the pedals in a randomized order under 4 settings: dark OR with black light illumination, dark OR with glow stick illumination, dark OR only, and brightly lit OR only. Endpoints included time to pedal activation, number of attempted, incomplete,

and incorrect pedal presses, dark adaptation, and surgeon preference. Analysis was performed using a Mann-Whitney U Test with  $p < 0.05$  considered significant.

**RESULTS:** Compared to no illumination, the glow stick (6.77s vs. 8.47s,  $p < 0.001$ ) and black light fluorescent illumination (5.34s vs. 8.47s,  $p < 0.001$ ) were both associated with decreased combined activation times and individual pedal activation times ( $p < 0.05$  for c-arm, laser, and URL). The black light system resulted in a significant decrease in attempted, incomplete, and incorrect pedal presses compared to the dark setting (0.30 vs. 3.45,  $p < 0.001$ ; 1.25 vs. 7.75,  $p < 0.001$ ; 0.35 vs. 1.25,  $p = 0.035$ , respectively) while demonstrating no difference compared to a brightly lit OR. Dark adaptation was significantly improved with black light illumination compared to a brightly lit OR (134.5 vs. 140.5 luminance units,  $p < 0.001$ ). Subjectively, 100% of participants preferred illuminated pedals for endourologic procedures compared to the dark OR, with 90% preferring the black light-fluorescent system.

**CONCLUSIONS:** During a simulated PCNL, color-coded black light foot pedal illumination significantly improved the accuracy and efficiency of instrument activation compared to the conventional dark

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operating room setting, while also maintaining dark adaptation for the surgeon.